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(54) Calibration procedure for wireless networks with direct mode traffic

Kalibrierungsverfahren für drahtlose Netze mit Direktverkehr

Procédé d'étalonnage pour les réseaux sans fil avec trafic de mode direct

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EP-A- 0 695 059	**EP-A- 0 853 400**
WO-A-98/56140	**US-A- 5 430 729**
US-A- 5 546 540	**US-A- 5 862 477**

EP 1 063 819 B1

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Description

[0001] The present invention relates to the calibration procedure for wireless networks with direct mode traffic, and in particular to the creation of a topology map indicating the quality of connectivity of each wireless device of a wireless network with all other wireless devices in said wireless network.

[0002] A typical wireless network, such as the IEEE 1394 based HIPERLAN type 2 broadband radio access network which specification is developed by ETSI is shown in Fig. 3. An access point or central controller 15 has an up- and downlink communication with several mobile terminals 11, 12, 13, and 14 and the mobile terminals can also have a direct communication in-between each other so that apart from the granting of resources for peer mobile terminals, e. g. the first mobile terminal 11 and the second mobile terminal 12, the access point or central controller 15 is not involved in the communication. Such direct communications in-between two or more mobile terminals are called direct mode. An IEEE 1394 bus with connected network devices is exemplary shown only for the fourth mobile terminal 14.

[0003] The problem in wireless networks including direct mode traffic is that the mobile terminals do not know with which other devices they have radio link. Thus, they intend to request the central controller 15 to set up certain connections even though they are not possible. A second problem is the transmit power control during direct mode traffic. Without knowledge about the radio link quality always maximum transmit power levels have to be used until appropriate levels are identified.

[0004] Therefore, a topology map has been introduced indicating the quality of connectivity of each network device of a wireless network with all other network devices in said wireless network. After distribution of this topology map, a mobile terminal can check whether a connection is possible or not before requesting it with the central controller. Furtheron, transmit power control can be performed using an initial power level determined on the quality of connectivity of the particular radio link.

[0005] Also, in case the topology map of the wireless network is not distributed in the whole network, but only stored within the central controller enables the cen-tral controller to accept or reject connection requests between two wireless devices depending on the radio link quality. Furthermore, once the topology map has been created, the central controller can inform the peer wireless devices to set up their transmit power levels accordingly until accurate transmit power control is performed.

[0006] Further information regarding the prior art can be found in EP 0 695 059 which relates to a wireless LAN to wired LAN bridge, in particular an internetworking node for providing internetworking services for mobile wireless nodes. It is taught that each mobile wireless node is registered with at the most one internetworking node. Each mobile wireless node emits a topology broadcast identifying itself and other nodes it has heard. Each internetworking node uses these topology broadcasts to construct a table tracking each mobile node within its range, whether that mobile node is registered to that internetworking node and also a list of which other nodes that mobile wireless node can hear. The internetworking node determines which of these wireless nodes it will register. The internetworking node will then act for all wireless nodes registered to it in relaying messages between wireless nodes or between a wired LAN and the wireless nodes.

[0007] US 5,862,477 discloses a topology verification process for controlling a Personal Communication Services (PCS) system which includes a plurality of Cordless Fixed Parts (CFP)s. The process includes mapping the spatial relationships of the CFPs utilizing Received Signal Strength Indication (RSSI) vectors resulting from test signals transmitted between the CFPs, to establish the topology of the system; repeating the mapping process after any disruption of power to the system, and comparing the results. Any significant change in the results, would be highly indicative of a potential change in the geographic area of operation of the system. and can be used to initiate disablement of the system operation.

[0008] In view of the above, it is the object of the present invention to provide a method to create a topology map indicating the quality of connectivity of each network device of a wireless network with all other network devices in said wireless network. Furtheron, it is the object of the present invention to provide network devices that are adapted to work according to the inventive method.

[0009] These objects are solved by the inventive method to create a topology map according to independent claim 1 and network devices for a wireless network according to independent claims 13 and 18. Preferred embodiments thereof are respectively defined in the respective dependent claims.

[0010] A method to create a topology map indicating the quality of connectivity of each network device of a wireless network with all other network devices in said wireless network according to the present invention comprises the following steps: performing a measurement phase in which a calibration signal is successively broadcasted by each network device and in which all respective other network devices receiving said calibration signal measure the received signal quality; performing a reporting phase in which the measurement results are transmitted from each network device to the network device creating said topology map; and performing a creating phase in which said topology map of the network is created within the network device creating said topology map on basis of all received measurement results.

[0011] Therefore, according to the present invention a very quick creation of the topology map is possible, since no bandwidth is wasted transmitting small amounts of data, namely single measurement results, from the network devices that have measured the received signal quality of one control signal to the network device creating said topology map, but since first all measurement results are collected before they are transmitted to the network device creating the topology map.

[0012] Preferably said measurement phase and/or said reporting phase are initiated by the network device creating the topology map.

[0013] Further, preferably the topology map is updated when a new network device joins the network and/or after a predetermined amount of time has lapsed.

[0014] A first type of network device for a wireless network according to the present invention is characterized by means to broadcast a calibration signal, to measure a power level of a received calibration signal, and to transmit its measurement results to another network device or to store it internally.

[0015] Preferably these functions are carried out on demand of another network device, but they can also be carried out on an internal demand. Therefore, the network device according to the present invention preferably comprises a decoder that initiates the broadcast of a control signal and the measurement of the reception quality of one or more incoming broadcast signals upon reception of a measurement control signal and that further preferably initiates the transmission of one or more measurement results upon reception of a reporting control signal.

[0016] Preferably the network device according to the present invention is characterized by a report encoder that receives one or more signal quality indication signals and encodes therefrom a signal quality control signal to be transmitted to said other network device or to be stored internally.

[0017] A second type of network device according to the present invention is characterized by means to initiate a measurement phase, to initiate a reporting phase, and to perform a creation of a topology map on basis of measurement results received during the reporting phase.

[0018] This second type of network device preferably includes all features of the first type of network device according to the present invention.

[0019] The first type of network device according to the present invention is either a mobile terminal or a mobile terminal having the functionality of a central controller, whereas the second type of network device according to the present invention always has the functionality of a central controller.

[0020] The present invention and its numerous embodiments will be better understood on basis of the following exemplary description thereof taken in conjunction with the accompanying drawings, in which

Fig. 1	shows a network device according to the present invention;
Fig. 2	shows the messaging in-between the central controller and two mobile terminals during the calibration procedure to create the topology map; and
Fig. 3	shows an exemplary wireless network.

[0021] The mobile terminal shown in Fig. 1 is adapted to perform a direct mode calibration according to the present invention. The shown mobile terminal has one antenna 1 which is connected to the movable terminal of a transmit/receive selection switch 2 which fixed terminals are respectively connected to the transmitter and receiver signal path of the mobile terminal. In the receiver signal path a receiver 3 is directly connected to the respective fixed terminal of the transmit/receive selection switch 2. This receiver 3 produces a data and control signal input to a controller 6 and also outputs a signal wherefrom a signal quality measurement unit 5 can determine the received signal strength which is output to the controller 6. For the transmitter signal path the controller 6 outputs a data and control signal to a transmitter 4 which modulates, up-converts and amplifies this signal to a given signal strength which is indicated to the transmitter 4 by a control signal generated by the controller 6 and outputs the generated transmission signal to the respective fixed terminal of the transmit/receive selection switch 2. Bi-directionally connected to the controller are a user interface 7 and a memory 8. Furtheron, the controller 6 is connected to a direct mode calibration decoder 9 and a direct mode report encoder 10.

[0022] The direct mode calibration decoder 9 receives the control signals generated by the receiver 3 via the controller 6 and initiates the broadcast of a calibration signal and the measurement of the reception quality of one or more incoming broadcasted calibration signals from other mobile terminals upon reception of a measurement control signal which is transmitted from the central controller 15. Furtheron, upon reception of a reporting control signal which is also transmitted from the central controller 15 the direct mode calibration decoder 9 initiates the transmission of one or more measurement results to said central controller 15. Therefore, all measurement results stored within the memory 8 are communicated to the direct mode report encoder 10 by the controller 6 and said direct mode report encoder 10 generates a signal quality control signal that is transmitted via the controller 6 and the transmitter 4 to the central controller 15. The central controller 15 creates a topology map on basis of all measurement results received from all mobile terminals during the reporting phase.

[0023] In the following the calibration procedure will be described in connection with Fig. 2 which shows the messaging in-between the central controller 15 having a medium access control identifier, i. e. MAC-ID3, and a first mobile terminal 11 having a MAC-ID1 and a second mobile terminal 12 having a MAC-ID2, after the calibration procedure is decided to be started, since either a new mobile terminal joins the network or a timer has expired.

[0024] In a first step S1 the central controller 15 send measurement control signals to both mobile terminals 11 and 12. Of course, the central controller 15 itself knows that the measurement phase of the calibration procedure will be performed. Therefore, after the first step S1 all three network devices, namely the central controller 15 and the first and second mobile terminals 11 and 12, are initialized to perform the measurement phase. During the measurement phase all network devices within the wireless network successively broadcast a calibration signal and receive the calibration signals transmitted by the other network devices to determine their respective signal quality. Therefore, in a step S2 the first mobile terminal 11 broadcasts its calibration signal to the central controller 15 and the second mobile terminal 12 which receive said calibration signal, measure its signal quality, and store it in an internal memory.

[0025] Thereafter, the central controller 15 itself performs the broadcast of a calibration signal to the first and second mobile terminals 11 and 12 in a step S3. Both mobile terminals 11 and 12 respectively receive the calibration signal, measure its signal quality and store this value in an internal memory. Following in a step S4 the second mobile terminal 12 also broadcasts a calibration signal to the first mobile terminal 11 and the central controller 15 which respectively receive this calibration signal, measure its signal quality and store this measured value in an internal memory. After all mobile terminals have broadcasted their calibration signals and these calibration signals are received and measured by all respective other devices, the central controller 15 transmits a reporting control signal in a step S5 to the first mobile terminal 11 and the second mobile terminal 12. After reception of the reporting control signal, both mobile terminals generate a signal quality control signal comprising one or more measurement results and transmit it respectively to the central controller 15. The first mobile terminal 11 transmits its signal quality control signal in a step S6 to the central controller 15 and the second mobile terminal 12 transmits its signal quality control signal to the central controller 15 in a step S7.

[0026] Of course, the central controller 15 knows its own measurement results, since they are already stored in its internal memory. Upon reception of all measurement results from all other mobile terminals within the network, the central controller 15 generates the topology map which indicates the reception quality for every radio link available within the network.

[0027] To summarize the above procedure it can be said that the calibration procedure mainly consists of two phases, namely the measurement phase and the reporting phase. In an exemplary embodiment of an IEEE 1394 based HIPERLAN type 2 network during the measurement phase the calibration slot is transmitted using a dedicated control channel. It contains the source identifier. The calibration slot is transmitted using the maximum allowed transmit power level in order to avoid artificial hidden nodes. Each other wireless device measures the received quality, e. g. by means of the received signal strength and stores it in an internal memory. During the reporting phase each wireless device reports its measurement results to the central controller using a dedicated control channel. The report slot contains the identifier of the wireless device and the report measurements. One or more measurement results can be transmitted in one report slot.

[0028] Once all wireless devices have reported their measurement results to the central controller, the central controller (in a third phase) creates a topology map of the network which indicates the quality of connectivity of each wireless device with all others. A possible topology map of a network with n active devis represented into a matrix is shown below:

▨	**MAC-ID1**	**MAC-ID2**	**MAC-ID3**	...	...	...	**MAC-IDn**
MAC-ID1	▨	RSS 1-2	RSS 1-3	...	...	...	RSS 1-n
MAC-ID2	RSS 2-1	▨	RSS 2-3	...	...	...	RSS 2-n
MAC-ID3	RSS 3-1		▨	...	...	...	RSS31-n
...	...	...	...	▨	...	...	...
...	...	...	...	...	▨	...	...
...	...	...	...	...	...	▨	...
MAC-IDn	RSS n-1	RSS n-2	RSS n-3	...	...	...	▨

[0029] RSS n-m represents the received signal strength at mobile terminal n when transmitted by mobile terminal m. The central controller is also regarded as mobile terminal, since in a wireless network environment with mobile terminals the task of the central controller might be switched from one mobile terminal to another. According to the example shown hereinafter 4 bits are used to map the received signal quality, i. e. the received power to a signal strength code. Therefore, there exist sixteen possibilities of designated received power levels to be included in the topology map. According to the shown example, a bandwidth of < -90 dBm to > -30dBm is set with a step size of 3 dB and a range of -69 dBm to -48 dBm as a medium range mapped to one coding value.

RSS2	Received Power at ARP [dBm]	Step Size
0000	< -90 dBm (no radio link)	
0001	-90	3 dB
0010	-87	
0011	-84	
0100	-81	
0101	-78	
0110	-75	
0111	-72	
1000	-69 ... -48	21 dB
1001	-45	3 dB
1010	-42	
1011	-39	
1100	-36	
1101	-33	
1110	-30	
1111	> -30 dBm	

[0030] Of course, any other mapping e. g. in a strictly linear or non-linear fashion can be performed as well.

[0031] An update of the topology map is always triggered by the central controller. It is started as a high priority calibration when a new mobile terminal joins the network so that an updated topology map is nearly immediately created,

e. g. within 2 ms. Furtheron, a low priority calibration is started every time when a timer expires, e. g. every 100 ms. Low priority in this sense means that the calibration is carried out every time free resources are available.

[0032] The topology map of the network might be broadcast by the central controller to all mobile terminals and depending on the used system it might be transmitted as a whole or line by line. A mobile terminal receiving the topology map preferably stores this topology map together with a time stamp. Another possibility to give knowledge about the network topology to a mobile terminal is to just transmit a particular line or value of the topology map to the corresponding network device.

[0033] Of course, the present invention is not only to be used with an IEEE 1394 based HIPERLAN type 2 network, but with any wireless network, preferably with such supporting direct mode.

Claims

1. Method to create a topology map indicating the quality of wireless connectivity of each network device (11-15) of a wireless network with all other network devices in said wireless network, comprising the following steps:
    - performing a measurement phase in which a calibration signal is successively broadcasted by each network device and in which all respective other network devices receiving said calibration signal measure the received signal quality;
    - performing a reporting phase in which the measurement results are wirelessly transmitted from each network device to the network device creating said topology map; and
    - performing a creating phase in which said topology map of the network is created within the network device creating said topology map on the basis of all received measurement results.

2. Method according to claim 1, wherein said calibration signal is transmitted in a dedicated control channel.

3. Method according to claim 1 or 2, wherein said measurement results are reported in a respective dedicated control channel.

4. Method according to anyone of the preceding claims, wherein said calibration signal is transmitted with the maximum allowed transmit power level.

5. Method according to anyone of the preceding claims, wherein said topology map is updated when a new network device joins the network.

6. Method according to anyone of the preceding claims, wherein said topology map is updated after a predetermined amount of time.

7. Method according to anyone of the preceding claims, wherein said topology map is stored in the central controller (15).

8. Method according to anyone of the preceding claims, wherein said topology map is broadcasted in the whole network.

9. Method according to anyone of claims 1 to 7, wherein only the parts of the topology map related to a specific network device are transmitted to said specific network device.

10. Method according to anyone of the preceding claims, wherein said calibration signal is transmitted using an omnidirectional antenna.

11. Method according to anyone of the preceding claims, wherein the contents of the topology map are codes that are mapped to receive power values.

12. Method according to anyone of the preceding claims, wherein said measurement phase and/or reporting phase is initiated by the network device creating said topology map.

13. Network device (11-15) for a wireless network, comprising means to broadcast (4) a calibration signal, to measure (5) a power level of a received calibration signal to internally store (8) results of said measurement and to wirelessly

transmit (4) its measurement results to another network device.

14. Network device according to claim 13, wherein said functions are performed on demand of another network device or on an internal demand.

15. Network device according to claim 13 or 14, comprising a calibration decoder (9) that initiates the broadcast of a calibration signal and the measurement of the reception quality of one or more incoming calibration signals upon reception of a measurement control signal.

16. Network device according to claim 15, wherein said calibration decoder (9) initiates the transmission of one or more measurement results upon reception of a reporting control signal.

17. Network device according to anyone of claims 13 to 16, comprising a report encoder (10) that receives one or more signal quality indication signals and encodes therefrom a signal quality control signal to be transmitted to said other network device.

18. Network device according to any one of claims 13-17, comprising means (6) to initiate a measurement phase, to initiate a reporting phase and to perform a creation of a topology map on basis of measurement results received during the reporting phase.

Patentansprüche

1. Verfahren zur Erzeugen einer Topologiekarte zur Veranschaulichung der Qualität drahtloser Verbindungen jedes Netzwerkgeräts eines drahtlosen Netzwerks mit entsprechenden anderen Netzwerkgeräten desselben Netzwerks, mit den folgenden Schritten:

    - Durchführen einer Messphase, in der sukzessiv jedes Netzwerkgerät ein Kalibriersignal aussendet, und alle jeweils anderen Netzwerkegeräte, die das Kalibriersignal empfangen, die Qualität des empfangenen Signals messen;
    - Durchführen einer Berichtphase, in der die Messergebnisse drahtlos von jedem Netzwerkgerät zu dem die Topologiekarte erzeugenden Netzwerkgerät übertragen werden, und
    - Durchführen einer Erzeugungsphase, in der die Topologiekarte des Netzwerks in dem die Topologiekarte erzeugenden Netzwerkgerät basierend auf allen erhaltenen Messergebnissen erzeugt wird.

2. Verfahren nach Anspruch 1, wobei das Kalibriersignal in einem bestimmten Steuerkanal übertragen wird.

3. Verfahren nach Anspruch 1 oder 2, wobei die Messergebnisse in einem bestimmten Steuerkanal berichtet werden.

4. Verfahren nach einem der vorstehenden Ansprüche, wobei das Kalibriersignal mit dem maximal erlaubten Übertragungspegel übertragen wird.

5. Verfahren nach einem der vorstehenden Ansprüche, wobei die Topologiekarte auf den neuesten Stand gebracht wird, wenn dem Netzwerk ein neues Netzwerkgerät zugefügt wird.

6. Verfahren nach einem der vorstehenden Ansprüche, wobei die Topologiekarte nach einer bestimmten Zeitspanne auf den neuesten Stand gebracht wird.

7. Verfahren nach einem der vorstehenden Ansprüche, wobei die Topologiekarte in dem Zentral-Controller (15) gespeichert wird.

8. Verfahren nach einem der vorstehenden Ansprüche, wobei die Topologiekarte über das gesamte Netzwerk ausgestrahlt wird.

9. Verfahren nach einem der Ansprüche 1 bis 7, wobei nur die Teile der Topologiekarte, die zu einem bestimmten Netzwerkgerät gehören, zu diesen spezifischen Netzwerkgerät übertragen werden.

10. Verfahren nach einem der vorstehenden Ansprüche, wobei das Kalibiriersignal unter Verwendung einer Rund-

strahlantenne übertragen wird.

11. Verfahren nach einem der vorstehenden Ansprüche, wobei der Inhalt der Topologiekarte Codes sind, die auf Empfangsstärke-Werte abgebildet werden.

12. Verfahren nach einem der vorstehenden Ansprüche, wobei die Messphase und/oder die Berichtphase durch das Netzwerkgerät initiiert wird, das die Topologiekarte erzeugt.

13. Netzwerkgerät (11-15) für ein drahtloses Netzwerk, mit einer Einrichtung (4) zum Verbreiten eines Kalibriersignals, um einen Pegel eines empfangenen Kalibriersignals zu messen und die Ergebnisse der Messung intern (8) zu speichern, und um drahtlos die Messergebnisse zu einem weiteren Netzwerkgerät zu übertragen.

14. Netzwerkgerät gemäß Anspruch 13, wobei die Funktionen auf Verlangen eines anderen Netzwerkgeräts oder bei interner Notwendigkeit durchgeführt werden.

15. Netzwerkgerät nach Anspruch 13 oder 14, mit einem Kalibrier-Dekoder (9), der das Verbreiten eines Kalibriersignals und die Messung der Empfangsqualität eines oder mehrerer eintreffender Kalibriersignale bei Empfang eines Messungs-Steuersignals initiiert.

16. Netzwerkgerät nach Anspruch 15, wobei der Kalibrier-Dekoder (9) die Übertragung eines oder mehrerer Messergebnisse bei Empfang eines Bericht-Steuersignals initiiert.

17. Netzwerkgerät nach einem der Ansprüche 13 bis 16, mit einem Bericht-Enkoder (10), der ein oder mehrere Signalqualität-Indikatorsignale empfängt und daraus ein zu den anderen Netzwerkgeräten zu übermittelndes Signalqualität-Steuersignal enkodiert.

18. Netzwerkgerät nach einem der Ansprüche 13 bis 17, mit einer Einrichtung (6) zum Initiieren einer Messphase, zum Initiieren einer Berichtphase und zum Durchführen der Erzeugung einer Topologiekarte basierend auf Messergebnissen, die während der Berichtphase erhalten wurden.

Revendications

1. Procédé de création d'une carte topologique indiquant la qualité d'une connectivité sans fil de chaque dispositif de réseau (11-15) d'un réseau sans fil à tous les autres dispositifs de réseau dans ledit réseau sans fil, comprenant les étapes consistant à :

   - effectuer une phase de mesure dans laquelle un signal d'étalonnage est successivement diffusé par chaque dispositif de réseau et dans lequel tous les autres dispositifs de réseau respectifs recevant ledit signal d'étalonnage mesurent la qualité du signal reçu ;
   - effectuer une phase de signalisation dans laquelle les résultats de mesure sont transmis par l'intermédiaire d'une connexion sans fil depuis chaque dispositif de réseau au dispositif de réseau créant ladite carte topologique ; et
   - effectuer une phase de création dans laquelle ladite carte topologique du réseau est créée à l'intérieur du dispositif de réseau créant ladite carte topologique en fonction de tous les résultats de mesure reçus.

2. Procédé selon la revendication 1, dans lequel ledit signal d'étalonnage est transmis dans un canal de contrôle spécialisé.

3. Procédé selon la revendication 1 ou 2, dans lequel lesdites résultats de mesure sont signalés dans un canal de contrôle spécialisé.

4. Procédé selon l'une quelconque des revendications précédentes, dans lequel ledit signal d'étalonnage est transmis avec le niveau de puissance de transmission permis maximum.

5. Procédé selon l'une quelconque des revendications précédentes, dans lequel ladite carte topologique est mise à jour lorsqu'un nouveau dispositif de réseau se joint au réseau.

6. Procédé selon l'une quelconque des revendications précédentes, dans lequel ladite carte topologique est mise à jour après une quantité prédéterminée de temps.

7. Procédé selon l'une quelconque des revendications précédentes, dans lequel ladite carte topologique est mémorisée dans l'unité de contrôle centrale (15).

8. Procédé selon l'une quelconque des revendications précédentes, dans lequel ladite carte topologique est diffusée dans le réseau tout entier.

9. Procédé selon l'une des revendications 1 à 7, dans lequel seulement les parties de la carte topologique ayant trait à un dispositif de réseau spécifique sont transmises audit dispositif de réseau spécifique.

10. Procédé selon l'une quelconque des revendications précédentes, dans lequel ledit signal d'étalonnage est transmis en utilisant une antenne omnidirectionnelle.

11. Procédé selon l'une quelconque des revendications précédentes, dans lequel les contenus de la carte topologique sont des codes qui sont appliqués pour recevoir des valeurs de puissance.

12. Procédé selon l'une quelconque des revendications précédentes, dans lequel ladite phase de mesure et/ou ladite phase de signalisation sont déclenchées par le dispositif de réseau créant ladite carte topologique.

13. Dispositif de réseau (11-15) pour un réseau sans fil, comprenant des moyens pour diffuser (4) un signal d'étalonnage, pour mesurer (5) un niveau de puissance d'un signal d'étalonnage reçu pour mémoriser intérieurement (8) les résultats de ladite mesure et pour transmettre par connexion sans fil (4) ses résultats de mesure à un autre dispositif de réseau.

14. Dispositif de réseau selon la revendication 13, dans lequel lesdites fonctions sont effectuées à la demande d'un autre dispositif de réseau ou par une demande interne.

15. Dispositif de réseau selon la revendication 13 ou 14, comprenant un décodeur d'étalonnage (9) qui déclenche la diffusion d'un signal d'étalonnage et la mesure de la qualité de réception d'un signal d'étalonnage entrant ou plus lors de la réception d'un signal de contrôle de mesure.

16. Dispositif de réseau selon la revendication 15, dans lequel ledit décodeur d'étalonnage (9) déclenche la transmission d'un résultat de mesure ou plus lors de la réception d'un signal de contrôle de signalisation.

17. Dispositif de réseau selon l'une quelconque des revendications 13 à 16, comprenant un codeur de signalisation (10) qui reçoit un signal d'indication de qualité de signal ou plus et code à partir de là un signal de contrôle de qualité de signal à transmettre audit autre dispositif de réseau.

18. Dispositif de réseau selon l'une quelconque des revendications 13 à 17, comprenant des moyens (6) pour déclencher une phase de mesure, pour déclencher une phase de signalisation et pour effectuer une création d'une carte topologique en fonction des résultats de mesure reçus durant la phase de signalisation.

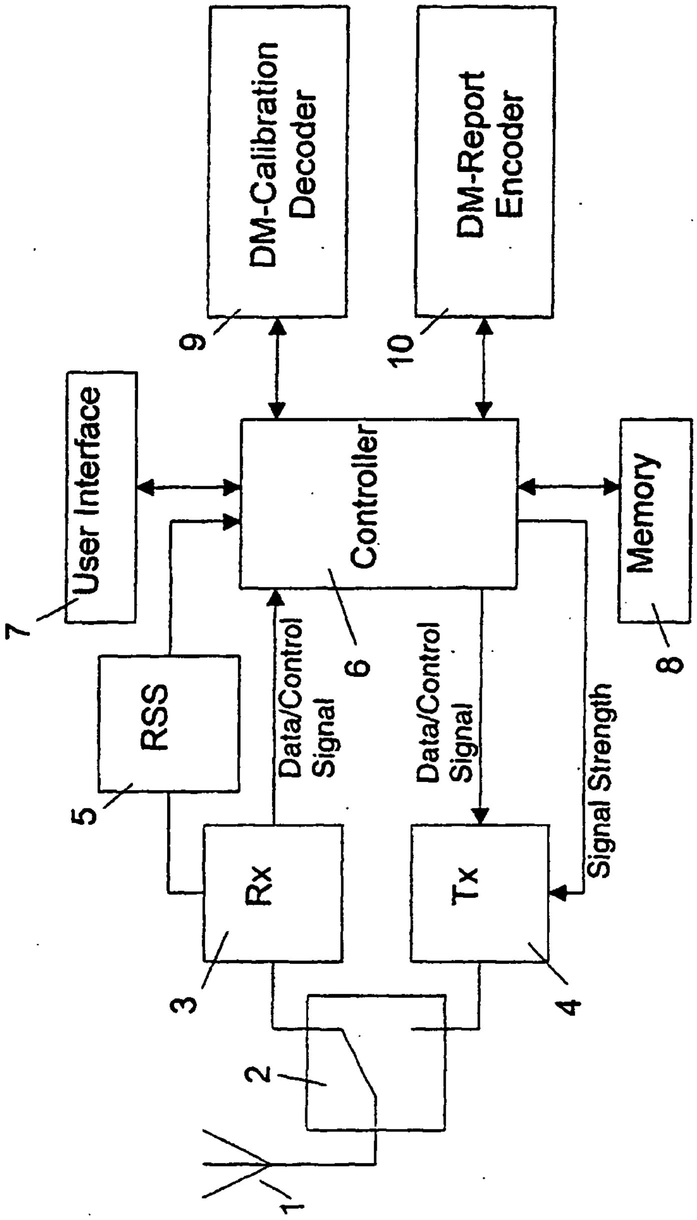
DM-Calibration Decoder
DM-Report Encoder
9
10
User Interface
7
Controller
6
Memory
8
RSS
5
Data/Control Signal
Data/Control Signal
Signal Strength
Rx
3
Tx
4
2
1

Fig. 1

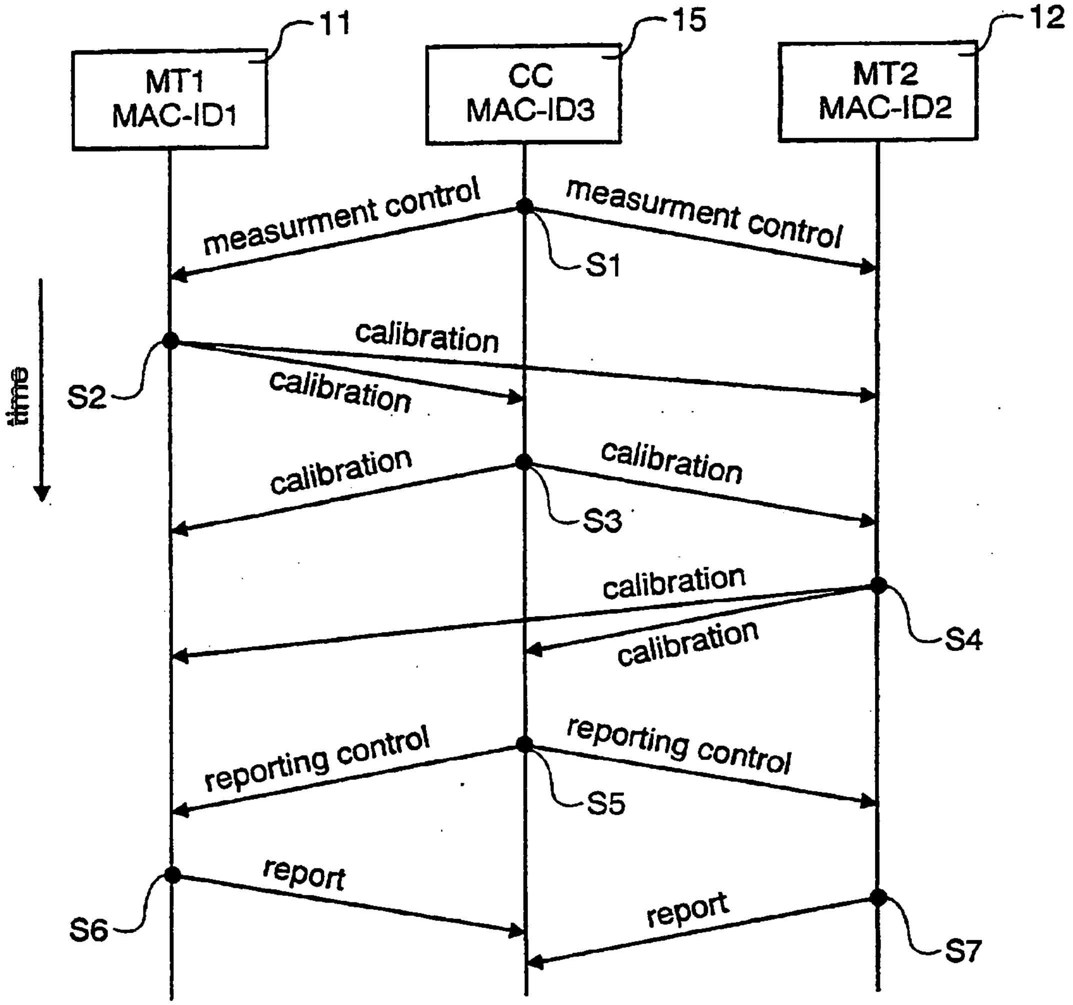
11
15
12
MT1
MAC-ID1
CC
MAC-ID3
MT2
MAC-ID2
measurment control
measurment control
S1
time
calibration
calibration
S2
calibration
calibration
S3
calibration
calibration
S4
reporting control
reporting control
S5
report
report
S6
S7

Fig. 2

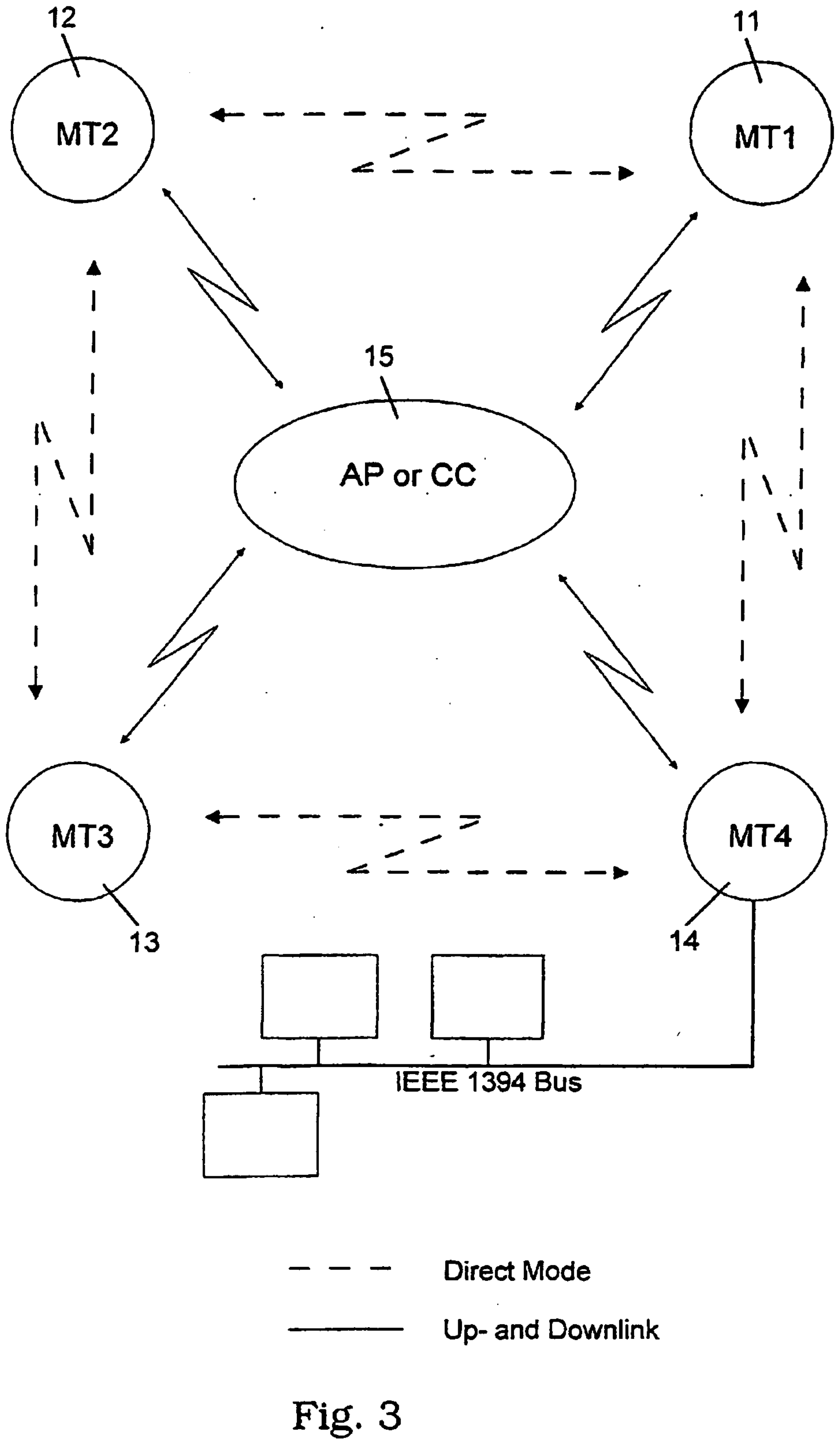
12
11
MT2
MT1
15
AP or CC
MT3
MT4
13
14
IEEE 1394 Bus
Direct Mode
Up- and Downlink

Fig. 3